OUR BOOK SHELF.

Die Meteorologie, ihrem neuesten Standpunkte gemäss, und mit besonderer Berücksichtigung geographischer Fragen dargestellt. Von Dr. Siegmund Günther. With 71 Illustrations. 304 pp. (Munich: Ackermann.)

DR. SIEGMUND GÜNTHER is already known by his "Lehrbuch der Geophysik," in two volumes, which appeared in 1884 and 1885, and runs up to nearly 1200 pages. The title of the present work is ambitious, and the endeavour to produce a text-book of the whole of meteorology in the space of 300 pages is a bold one. The work is a digest of existing text-books, such as Van Bebber's "Handbuch der ausübenden Witterungskunde," and Sprung's "Lehrbuch der Meteorologie." It is therefore excessively condensed, and to such an extent that it can only be used as a sort of index, for on all the subjects discussed, the reader is referred to other sources of information. The conception of the treatise is good enough, and the subdivisions are: (1) the general properties of the atmosphere, and observations thereon; (2) the movements of the atmosphere; (3) general climatology; and (4) the special climatology of the different zones. These are followed by two appendixes which might well have formed separate chapters; their subjects are, respectively, practical weather knowledge, and optical meteorology.

As might be expected, the sources of Dr. Günther's information are almost exclusively German, so that his *résumé* is slightly one-sided. This is especially the case when he is dealing with marine meteorology, as he almost ignores all work and all methods except those of the Deutsche Seewarte. In his notice of the marine barometer (p. 45), he entirely omits any mention of the principle by which the necessity for a capacity correction is dispensed with by the employment of a modified scale of inches. In speaking of the origin of weather telegraphy, Dr. Günther does scant justice to FitzRoy, who is merely casually mentioned as a former head of the English office. At p. 39 he gives the reader to understand that Kew, Pawlowsk, and Zikawei are the only stations in the world employing photographic self-recording instruments. A more serious slip, for a German, is at p. 243, where he speaks of two international Congresses at Leipzig and Rome, forgetting that the private meeting at Leipzig in 1872 was only preliminary to the Congress of Vienna in the following year. The correction of the press has not been carefully done: not only are letters dropped out in the printing of Latin and English words, but even in the German we have noticed several slips.

However, Dr. Günther's work is undoubtedly useful as indicating to geographers the main outlines of existing knowledge in the most important branches of science with which they come in contact at every turn, and also the lines in which further investigation is desirable.

Haunts of Nature. By H. W. S. Worsley-Benison. (London: Elliot Stock, 1889.)

SOME time ago we had the pleasure of recommending an excellent little book by Mr. Worsley-Benison, called "Nature's Fairy-land," consisting of a series of simple, pleasantly-written papers on some of those aspects of Nature which are most likely to excite the interest of children. The present volume has been planned on exactly the same lines, and is in every way worthy of its predecessor. In the opening essay the author describes the proceedings of two house-martins who did him the honour to select as the site for their nest a small wooden projection under the eaves of his roof. This paper has all the freshness and charm that spring from direct observation, and young people will read it with genuine pleasure. Among the subjects dealt with in other papers are wild roses, water scavengers, the dragon-fly's haunt, protective mimicry in insects, "fast asleep for months," and the ministry of leaves.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Structure and Distribution of Coral Reefs.

I AM somewhat disappointed that my criticism of Prof. Bonney's appendix in the last edition of Mr. Darwin's work on "Coral Reefs" has resulted only in an affair of outposts on the part of my opponents, since the main body of my arguments remains to be assailed. It would have been interesting, for instance, to obtain some further information concerning the evidence establishing the existence of the "90-fathom" reef of Rodriguez; and I should have welcomed the opinion of some zoologist as to the degree of our acquaintance with the fauna of the greater depths, say between 30 and 100 fathoms, around the shores of tropical islands in the Indian and Pacific Oceans. If this acquaintance is as scanty as I contend it is, then it is premature to fix the absolute limit of depth of the reef-coral zone.

At present, however, I shall be content with the establishment of the fact that corals occasionally grow in greater depths than 20 or 30 fathoms; and it was with this intention that I purposely singled out Commander Moore's observation in his Report on the Tizard and Macclesfield Banks. It is just this occasional greater depth of reef-coral growth that is the *crux* of the whole matter as far as the necessity for a theory of subsidence is concerned. Prof. Bonney admits in his last letter that "reef-building corals occasionally grow at depths considerably greater than 25 fathoms," and thus practically abandons the scanty foundation on which the surviving portion of the theory of subsidence now rests. My critic in this manner dispenses with the necessity of a movement of subsidence to explain the circumstance that lagoons are occasionally deeper than the usual limit of depth of the reef-coral zone, and to account for the occasional considerable thickness of upraised coral reefs. The supporters of Mr. Murray's anti-subsidence views will welcome this admission. It removes, in the first case, one of the chief points in favour of subsidence brought into prominence by Agassiz and Geikie in their hostile criticisms of the theory of Mr. Darwin—I refer to the abnormal depths of some atolls. In the second case, it shows that some of the evidence ranged in Prof. Bonney's appendix on the side of Darwin—I allude to that concerning the thickness of the upraised reefs of Cuba and the depth of limestone penetrated by the artesian borings at Oahu—should at least be placed in a neutral position. This is especially necessary in the instance of the artesian borings at Oahu, since Prof. Agassiz in his recent extensive memoir on the Hawaiian reefs,[1] which has not hitherto been quoted in this discussion, regards the borings from a point of view very different from the standpoint of Prof. Dana.

In this and in my previous letters I have shown to the best of my ability that nearly all the evidence ranged by Prof. Bonney on the side of Darwin should be placed at least in a neutral position. It almost all hinges on inferences that have not been established, or else on assumptions that cannot yet be proved. Surely the "90-fathom" reef of Rodriguez, if there has been no mistake in the matter, can be explained without subsidence by those who admit that "reef-building corals occasionally grow at depths considerably greater than 25 fathoms." The upraised reefs of Cuba must be placed on neutral ground. Masámarhu Island I have claimed for Mr. Murray. Lastly, there remain the artesian borings at Oahu; and, accepting Prof. Agassiz as our authority, we do not at present receive them as in favour of subsidence.

H. B. GUPPY.

June 11.

P.S.—After writing the above, I received a letter from Mr. John Murray, relating to the "90-fathom" reef of Rodriguez; he has kindly allowed me to quote from it the following remarks:—"I have examined all the charts and other available information, and have consulted some of the surveyors of the island. The result is that I don't think Prof. Balfour had sufficient grounds for stating with regard to Rodriguez that 'an older reef exists now quite submerged in some places to a depth of over 90 fathoms. Upon it the present reef rests, and it extends westward nearly fifteen miles from the present coast, while on the east it stretches

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[1] Bulletin of the Museum of Comparative Zoology at Harvard College, vol. xvii., No. 3, April 1889.

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about six miles' (Phil. Trans. R.S., vol. clxviii. p. 289; quoted on p. 308 of Darwin's 'Coral Reefs,' third edition). Here he evidently refers to the shallow water extending on all sides to the 100-fathom line, where there is about that depth a sudden fall. The fact is, such a character belongs to a large number of oceanic islands, whether surrounded by fringing reefs or no reefs whatever, and is due to quite other causes than reef-building."

June 14. H. B. G.

The Fireball of May 29, 1889.

THE fireball which I mentioned in NATURE of June 13 (p. 150) as having been seen at Leeds on May 29, was also observed at Belfast by Mr. I. W. Ward, who recorded the latter part of its course as from Vega to α Cygni.

Comparing this path with that assigned by Mr. D. Booth at Leeds, I find the radiant point at $214\frac{1}{2}^\circ - 7^\circ$, which was in azimuth 11° (west of south), and altitude $28\frac{1}{2}^\circ$ at the time (10h. 45m.) of observation.

When first seen at Leeds the fireball was situated over a point in the Irish Sea, in lat. 53° 58′ N., long. 5° 22′ W., and its height was sixty-one miles. At its disappearance it was six miles west-south-west of Stranraer on the coast of Wigtown, Scotland, at a height of twenty-five miles. The earth point was ten miles west of Troon, Ayrshire. The real length of path traversed was seventy-five miles, and the velocity eight and a third miles per second deduced from the estimated time of flight (nine seconds) at Leeds.

The radiant point at $214\frac{1}{2}^\circ - 7^\circ$ in Libra is situated near the earth's anti-apex, and the motion of the fireball would therefore be extremely slow, as it must have overtaken the earth in her orbit. It is curious that several doubly-observed meteors which have made their apparitions in the spring months have given the same radiant point. Thus the large fireball of May 12, 1878, seen in Scotland and the north of England had a radiant at $214^\circ - 7^\circ$ (Prof. A. S. Herschel). The conspicuous meteor of April 21, 1889, observed by Prof. Herschel at Croydon and the writer at Bristol, had a radiant at $218^\circ - 5^\circ$. The vernal months appear to furnish us with a long-enduring shower from this special region of the zodiac. W. F. DENNING.

Bristol, June 15.

Meteor.

ABOUT 11.30 p.m. on the night of June 13, the sky being partially covered with fleecy clouds slowly drifting from the south-west, so that the full moon was frequently obscured, a shooting-star appeared in the north, at an elevation of about 50° to 60°, and descended obliquely towards the east. It was as bright as a star of the first magnitude, and was visible during a slightly zigzag flight of some 30°, leaving no trail. But the remarkable thing was that the sky in that quarter was pretty closely covered with the slowly-moving fleecy clouds, so that no fixed stars were visible. The meteor, therefore, must have been below the clouds, at least in the latter part of its course.

Birstal Hill, Leicester. F. T. MOTT.

Stationary Dust-Whirl.

YESTERDAY morning, at 9.30, I was fortunate in witnessing a stationary dust-whirl, about a hundred yards from where I stood, on a dust-covered highway lying due east and west. The morning was warm, 67°·5 in the shade, barometer at 30·06, and the sky clear, excepting a few isolated cumulus patches. The air was still, the wind-vane indicating north-west. The appearance of the whirl presented a resemblance to a fountain of water playing, only the base was broader than the upper part, which was perfectly columnar. It remained, for nearly five minutes, absolutely stationary, then suddenly ceased, recommencing for a few seconds, on a much smaller scale, some ten yards westwards. Its height, when at its best, would be about 25 feet, and its diameter, midway, 2 feet. I could not correctly ascertain the spiral motions of the whirl, but judged the outer spiral to move from right to left, and upwards. The wind jumped round into the north-east shortly afterwards, with clear sky, and the barometer steadily rising. No others were seen during the day. J. LOVEL.

Driffield, June 17.

Bunsen's Photometer.

IF we place the "grease-spot" screen between two sources of light, situated at A and B, whose intensities are I and I′ respectively, and if C be the position of the screen for which the spot disappears when viewed from the side towards A, and C′ the corresponding position when viewed from the other side, it is usual to say: Take the mean of AC and AC′, and the mean of BC and BC′; the squares of the means will be approximately proportional to the intensities.

The relation

$$\frac{\mathrm{I}}{\mathrm{I}'} = \frac{\mathrm{AC} \,.\, \mathrm{AC}'}{\mathrm{BC} \,.\, \mathrm{BC}'}$$

is more exact, as may be shown by the following:—

Let a be the fraction of the light falling on unit area of the spot from A which reaches the eye, and b the corresponding fraction for the dry part; and let c and d be the respective fractions of the light falling on the other side of the paper, which, after passing through, reach the eye. Then, since the spot and the dry part in the position C are equally bright when viewed from the side towards A, we have, equating the light per unit area from the two parts—

$$\frac{\mathrm{I}}{\mathrm{AC}^2}a + \frac{\mathrm{I}'}{\mathrm{BC}^2}c = \frac{\mathrm{I}}{\mathrm{AC}^2}b + \frac{\mathrm{I}'}{\mathrm{BC}^2}d,$$

or

$$\frac{\mathrm{I}}{\mathrm{AC}^2}(a - b) = \frac{\mathrm{I}'}{\mathrm{BC}^2}(d - c) \,.\,.\,.\,.\,.\,. (1)$$

If C′ be the position of the screen for which the parts appear equally bright, as seen from the other side, we have—

$$\frac{\mathrm{I}}{\mathrm{AC}'^2}c + \frac{\mathrm{I}'}{\mathrm{BC}'^2}a = \frac{\mathrm{I}}{\mathrm{AC}'^2}d + \frac{\mathrm{I}'}{\mathrm{BC}'^2}b,$$

or

$$\frac{\mathrm{I}'}{\mathrm{BC}'^2}(a - b) = \frac{\mathrm{I}}{\mathrm{AC}'^2}(d - c) \quad .\,.\,.\,.\,. (2)$$

From (1) and (2)—

$$\frac{\mathrm{I}}{\mathrm{I}'} = \frac{\mathrm{AC} \,.\, \mathrm{AC}'}{\mathrm{BC} \,.\, \mathrm{BC}'}.$$

If $a + c = b + d$, we see that C and C′ must coincide. This condition implies that the light lost is the same for the spot and for its surroundings.

In the method of using the photometer, in which the two lights to be compared are balanced successively against a third light, and the spot in both cases is viewed from the same side, the inequality of the portions of light lost by the two parts does not disturb the result. D. M. LEWIS.

University College, Bangor, June 6.

THE TUTICORIN PEARL FISHERY.

AFTER an interval of more than twenty-seven years, the pearl-oyster (*Avicula fucata*, Gould) has produced pearls off the Madras coast of the Gulf of Manaar, in sufficient quantities to be worth the expense of fishing. The last fishery of the Tuticorin banks took place in the years 1860-62, and resulted in a net profit to Government of Rs. 3,79,297 (£37,929 at par). In olden times, when Tuticorin was in the possession of the Portuguese and Dutch, the fishery used to be carried on much more frequently than it is at the present day, and a difficult problem, which remains to be solved, is, What are the causes of the decline of the pearl fishery, and how can the Tuticorin banks be made to yield a more frequent harvest? Whether the baneful influence of the Mollusca known locally as *sooram* and *killikoy* (Modiota sp., and Avicula sp.), the ravages of the file-fishes (Balistes) and Rays (Trygon, &c.), poaching, or currents, are responsible for the non-production of an abundant crop of adult pearl-producing oysters during more than a quarter of a century, it would be impossible to decide until our knowledge of the conditions under which the pearl-oysters breed, develop, and live, is more precise than it is at present.

Superstition, as of old, still clings to the native divers; and I read, in a recent issue of the *Times of Ceylon*, that "at present there are said to be 150 boats, with their full complement of men, all waiting at Kilakarai in readiness

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